REMARKS

Reconsideration and allowance are requested. Claims 1-17 are pending, with claims 1, 16, and 17 being independent. Claim 17 has been amended. No new matter has been added.

Drawings

I. Prior Art Labels

The drawings have been objected to for failing to label alleged prior art with a legend. This rejection is traversed.

Formal drawings are submitted herewith. In the formal drawings, FIGS. 1A, 1B, 2A, 2B, 3A, 3B, and 3C include designations that indicate the drawings include prior art. The applicant submits that the subject matter of FIGS. 1C, 1D, 2C, 2D, and 3D disclose material that was not in the prior art and, as such, should not include a prior art designation. As examples, FIGS. 1C and 2C, and 1D and 2D, disclose the use of an A-SODEM and an A-SISO, respectively, for use in an iterative receiver in an approach to adaptive iterative detection, which is not disclosed in the prior art (page 9, lines 2-6; see page 49, line 20 through page 50, line 4). Also, FIG. 3D includes a combination of a channel mitigation and channel estimation components that are included in a receiver based on an adaptive iterative detection principle, which is not disclosed in the prior art (see page 18, lines 12-14; page 7, lines 7-8).

II. Referencing and Describing Drawings

FIGS. 1C, 1D, 2C, 2D, 5, 10, and 16 were objected to for allegedly not being referenced to or described by the specification. This rejection is traversed.

Each of the FIGS. 1C, 1D, 2C, 2D, 5, 10, and 16 was referenced and described in the application as filed. As examples, FIGS. 1C and 1D are described on page 49, line 21 through page 50, line 4; FIGS. 2C and 2D are described on page 63, lines 2-8; FIG. 5 is described on page 34, lines 2-10; FIG. 10 is described on page 45, line 22 through page 46, line 9; and FIG. 16 is described on page 76, line 7-19. Thus, the objection to the drawings should be withdrawn.

III. Objection under 37 C.F.R. 1.83(a)

The drawings have been objected to for allegedly not showing every feature of the invention specified in the claims. In particular, the Kalman filter, phase-locked loop, and the open-loop estimator of claims 11, 14, and 15, respectively, have allegedly not been shown in the drawings. This objection is traversed.

A Kalman filter, phase-locked loop, and open-loop estimator are all examples of channel estimators. FIG. 6, as a formal drawing, has been drawn to show this, as the channel estimators in FIG. 6 include, for example, the text "Channel Estimator (e.g., Kalman filter, Phase-Locked Loop, Open-Loop Estimator, etc.)." Support can be found in the application as originally filed. As examples, the specification includes:

"the channel estimator (DD-PLL)," page 63, lines 22-23 (note, PLL is commonly referred to in the art and the specification as phase-locked loop; see below); and

"...replace the parameter estimators in the A-SISO or A-SODEM by some non-linear estimator. For example, an Extended Kalman Filter (EKF) or a Phase-Locked Loop (PLL) may be used. In the present disclosure, the latter approach is considered. Regarding the channel estimator, a simple first order Decision

Directed PLL (DD-PLL) is used in place of the RLS technique with noise equivalent bandwidth (normalized to the symbol time)," page 58, line 23 through page 59, line 7.

Thus, for at least the reasons mentioned above, the objections to the drawings should be withdrawn.

Specification

The specification is objected to as allegedly failing to provide proper antecedent basis for the claimed subject matter. Specifically, min/sum; sum/product; max/product; min*/sum; Kalman filter channel estimator for each trellis state in each forward and backward operators; a least mean-square estimator for each trellis state in each of the forward and backward operators; a non-linear estimator for each trellis state in each of the forward and backward operators; and an open-loop estimator for each trellis state of the forward and backward operators. This objection is traversed.

The applicant submits that the claims, as filed, provide sufficient antecedent basis. "To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention." MPEP 2163 (citing Moba, B.V. v. Diamond Automation, Inc., 325 F.3d 1306, 1319, 66 USPQ2d 1429, 1438 (Fed. Cir. 2003))(emphasis added). The "original claims constitute their own description)" and thus can be used to support a showing of antecedent basis. MPEP 2163. "There is a strong presumption that an adequate written description of the claimed invention is present when the application is filed. In re Wertheim, 541 F.2d 257, 263, 191 USPQ 90, 97 (CCPA 1976) ('we are of the opinion that the PTO has the initial burden of

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presenting evidence or reasons why persons skilled in the art would not recognize in the disclosure a description of the invention defined by the claims')." MPEP 2163. The applicant submits that the claims show that the inventors were in possession of the invention. The Official Action gives no evidence or reasons why persons skilled in the art would not recognize the claimed subject matter as being possessed by the applicant. Because the claims have not been amended, and the applicant was in possession of the invention according to the original description contained in the claims, the rejection should be withdrawn.

Further support for the claims can be found in the detailed description. In the detailed description, the descriptions of min/sum, sum/product, and min*/sum operators provide antecedent basis. Min/sum operators, for example, are described as ACS operators on page 57, lines 8-15. In that section, "sum product operators" are also described. Min*/sum operators are described as being interchangeable with min/sum operators, as "all APP techniques may be constructed from their MSM counterparts by replacing the function in the ACS operation by min*=min(x,y)-log(1+exp(-|x-y|))" (page 41, lines 14-18).

Also, the detailed description implicitly provides antecedent basis for the min/sum, sum/product, and max/product operators. One skilled in the art would implicitly know that the different operators are interchangeable. For example, Aji and McEliece in The Generalized Distributive Law (46 IEEE Transactions on Information Theory, No. 2, 325 (March 2000)) define that the different operations can be used, and are interchangeable. For example, "[i]n fact, semirings 5-8 are all isomorphic to each other; for example, 5 [i.e., min-product] becomes 6 [i.e., max-product] via the mapping x→1/x, and 6

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[i.e., max-product] becomes 7 [i.e., min-sum] under the mapping
x $\rightarrow$ -log x."(page 327, col. 1; text in brackets added to clarify
the reference numbers). As another example, Freeman and Weiss
in <u>On the Fixed Points of the Max-Product Algorithm</u> (Mitsubishi
Electric Research Laboratory, TR-99-39 (January 2000)) equate
the max-product and min-sum algorithms ("the max-product
algorithm (or the equivalent min-sum algorithm[)]", "the max-
product is a two-way version of the Viterbi algorithm"; see
abstract, page 8), and the max-product and sum-product are
interchangeable ("[f]or Gaussians, max-product and sum-product
are identical."; <u>Id</u>. at page 7). Thus, sufficient antecedent
basis is in the specification as filed because one skilled in
the art would have implicitly understood that the operators were
interchangeable, the use of different operators is described in
the specification (as discussed above), and the claims as
originally filed sufficiently describe the operators.

As per "each of said forward and backward operators
includes a Kalman filter channel estimator for each trellis
state," "each of said forward and backward operators includes a
least mean-square estimator for each trellis state," "each of
said forward and backward operators includes a non-linear
estimator for each trellis state," and "each of said forward and
backward operators includes an open-loop estimator for each
trellis state," antecedent basis can be found explicitly and/or
implicitly in the detailed description. As examples,

"Regarding the particular channel estimator used, the
complexity increases in the order LMS [i.e., least mean-square],
RLS, KF [i.e., Kalman filter], AKF, PCKF, with the KF and the
AKF having almost equal complexity," page 42, lines 1-3;

"Another approach is to maintain the non-linear observation
equation and replace the parameter estimators in the A-SISO or

A-SODEM by some non-linear estimator," page 58, line 22 through page 59, line 1; and

"A KF channel estimate is kept for every trellis state and updated in a PSP fashion," page 36, lines 21-22.

In addition, because an open-loop estimator is known to one skilled in the art for use in soft decoding (see e.g., H. Meyr, M. Moeneclaey and S. A. Fechtel, Digital Communication Receivers: Synchronization, Channel Estimation and Signal Processing 80 (Wiley, New York 1998) ("two categories of synchronizers...(or open loop) synchronizers")), the disclosure of an open-loop estimator in claim 15 is sufficient to show that the inventors had possession of the claimed subject matter.

Thus, for at least the reasons stated above, the objection to the specification should be withdrawn.

Claim Objection

Claim 8 is objected to because it is allegedly substantially identical to claim 3. This objection is traversed.

The objection is improper and should be withdrawn. Under 35 U.S.C. 132, entitled "Notice of Rejection; Reexamination,"

(a) Whenever, on examination, any claim for a patent is rejected, or any objection or requirement made, the Director shall notify the applicant thereof, stating the reasons for such rejection, or objection or requirement, together with such information and references as may be useful in judging of the propriety of continuing the prosecution of his application.

For at least the reason that there is no such known objection under the patent laws and regulations, and no notice was given to the applicant that was sufficient to be useful in

judging the propriety of the objection (i.e., no law or regulation was cited in the Official Action), under 35 U.S.C. 132 the objection is improper and should be withdrawn.

Claim Rejections

I. Rejection under 35 U.S.C. 112, 1st Paragraph

Claim 14 is rejected as allegedly failing to enable one skilled in the art to use a "phase locked loop as a non-linear estimator for each trellis state." The Official Action states that the use is not well known or an accepted procedure in the art. This rejection is traversed.

As an initial matter, the Patent Office appears to have mistakenly rejected claim 14 due to a misinterpretation of claim 14. Although claim 14 is rejected for allegedly failing to enable a Phase-locked loop (PLL) as "a non-linear estimator of a trellis state" (Official Action, page 4), claim 14 does not recite that. The claims recite that there is an estimator <u>for</u> each trellis state, not <u>of</u> each trellis state ("wherein said non-linear estimator is a phase-locked loop" (claim 14) where the system "includes a non-linear estimator <u>for</u> each Trellis state" (emphasis added; claim 13)). PLLs estimate, for example, parameters (see e.g., "where g is a complex amplitude parameter...the complex amplitude g is estimated," page 58, lines 20-22).

Notwithstanding the apparent mistaken rejection of claim 14, claim 14 is enabled. To enable claim 14, the specification enables one skilled in the art such that a "non-linear estimator is a phase-locked loop" (claim 14) where the system "includes a non-linear estimator for each Trellis state." For example, the description on page 58, line 22 through page 59, line 2 enables

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one skilled in the art to make or use a PLL as a non-linear estimator.

Thus, for at least the reasons mentioned above, the rejection should be withdrawn.

II. Rejections under 35 U.S.C. 112, 2nd Paragraph

Claims 3-7 and 9-10 are rejected for allegedly being indefinite. In general, the claims use a notation that includes the use of a forward slash ("/"). For example, "min/sum" (claim 3). This notation allegedly makes the claims indefinite. The rejection is traversed.

Under 35 U.S.C. 112 the test is whether a person of ordinary skill in the art could interpret the metes and bounds of the claim. The test "is...not whether more suitable language or modes of expression are available." "[T]he examiner...should allow claims which define the patentable subject matter <u>with a reasonable degree of particularity and distinctness</u>. <u>Some latitude</u> in the manner of expression and the aptness of terms <u>should be permitted</u> even though the claim language is not as precise as the examiner might desire" (emphasis added; MPEP 2173.02).

One of ordinary skill in the art could interpret the metes and bounds of the claim as the terms min/sum, sum/product, max/sum, and min*/sum are all terms that would be understood to one of ordinary skill in the art. For example, N. Wiberg, H.-A. Loeliger and R. Kötter, use the terms "min/sum" and "sum/product" in a paper entitled <u>Codes and Iterative Decoding on General Graphs</u> (6 European Transaction on Telecommunications, 513-525 (Sept/Oct. 1995). As another example, Aji and McEliece in <u>The Generalized Distributive Law</u> (46 IEEE Transactions on Information Theory, No. 2, 325 (March 2000)), include the terms

"min-sum," "sum-product," and "max-sum" in a chart and discuss the terms. The term min*/sum, as discussed above is also well-described in the patent application (see e.g., page 41, line 18 ("min*=min(x,y)-log(1+exp(-|x-y|))")). Although the terms, as used in the claims, use a notation that includes a forward slash ("/"), instead of a dash ("-"), it is believed that one of ordinary skill in the art would have understood this notation in the context of soft-decoding and could interpret the metes and bounds of the claim. Thus, for the reasons stated above, this rejection should be withdrawn.

III. Rejections under 35 U.S.C. 102(b)

Claim 17 was rejected as allegedly being anticipated by Sandell et al. (Iterative Channel Estimation using Soft Decision Feedback, Global Telecommunications Conference (Nov. 1998); hereafter "Sandell"). This rejection is traversed.

As amended, claim 17 defines a channel processor to operate to produce and update soft information by:

generating a first sequence of soft information by performing a forward recursion,

estimating channel parameters using said first sequence of soft information and said plurality of coded symbols,

generating a second sequence of soft information by performing a backward recursion,

estimating channel parameters using said second sequence of soft information and said plurality of coded symbols,

computing a transitional information that ties forward and backward estimates of said first and second sequences of soft information together, and

generating soft information on said plurality of coded symbols and outputs of said channel processor by combining updated first and second sequences of soft information and said transitional information (claim 17).

Sandell does not disclose an iterative receiver that comprises such a channel processor and therefore cannot anticipate the subject matter of claim 17. Thus, the rejection should be withdrawn.

IV. Rejections under 35 U.S.C. 103(a)

Claims 1-6, 11-13, 15, and 16 were rejected as allegedly being unpatentable over Viterbi et al. (U.S. Pat. No. 5,933,462; hereafter "Viterbi") in view of Parr et al. (U.S. Pat. No. 5,537,419; hereafter "Parr"), Baccarelli et al. (Combined Channel Estimation and Data Detection Using Soft Statistics for Frequency-Selective Fast-Fading Digital Links, 46 IEEE Transactions on Communications, No. 4 (April 1998); hereafter "Baccarelli"), and/or Suarez et al. (U.S. Pat. No. 6,128,346; hereafter "Suarez"). This rejection is traversed.

The following criteria are required to establish a prima facie case of obviousness: (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine reference teachings, (2) there must be a reasonable expectation of success, and (3) the combined prior art references must teach or suggest all the claim limitations (see MPEP 706.02(j)). The Official Action fails to meet these criteria. The rejected claims are patentable over Viterbi in view of Parr for at least the reasons that (A) there is no motivation to combine Viterbi and Parr; and (B) the prior art

teaches away from a combination of the subject matter of Viterbi
and Parr that results in the claimed subject matter.

(A) No Motivation to Combine

As an initial matter, applicant submits that the Patent
Office has failed to meet its burden of establishing a prima
facie case of obviousness based on objective evidence in the
record. In re Grasselli, 713 F.2d 731, 739 (Fed. Cir. 1983); In
re Lee, 277 F.3d 1338, 1342 (Fed. Cir. 2002). Rather, the
Official Action is replete with holes - that is, veritable
admissions that that the art of record fails to disclose or
suggest several features of the claims - that the Patent Office
attempts to plug with wholly unsupported and conclusory
assertions of obviousness and motivations to combine or modify.

By failing to identify specific teachings in the cited art
for several of the claim features, the Official Action
implicitly acknowledges that the cited art - regardless of how
it hypothetically may be combined - fails to disclose or suggest
the subject matter of the claims. Under such circumstances, the
Patent Office has only two permissible options: (1) concede that
the claims are patentable over the cited art and allow the
application, or (2) attempt to locate and cite additional
references or other evidentiary support to fill the holes in the
Patent Office's deficient rejections. But in this case, the
Patent Office chose a third, albeit impermissible, course of
action - namely, making wholly unsupported assertions and
conclusory statements that the claim features not taught or
suggested in the art of record are obvious or inherent simply
because the Patent Office says so.

The Federal Circuit has recently reaffirmed that
obviousness rejections based on assertions lacking evidentiary

support in the record cannot stand. In <u>In re Lee</u>, 277 F.3d 1338 (Fed. Cir. 2002), the Federal Circuit vacated a Patent Office Board affirmance of an obviousness rejection because, rather than relying on objective evidence, the Patent Office based its obviousness rejection on conclusory statements having no evidentiary support in the record. <u>Id</u>. at 1342-43. In doing so, the Federal Circuit made it abundantly clear that "subjective belief and unknown authority" and "[assertions of] common knowledge and common sense" are not "a substitute for evidence." <u>Id</u>. at 1343-44.

In direct violation of <u>In re Lee</u>, the Official Action is replete with more several such unsupported assertions and conclusory statements. Examples of these improper statements can be found on each of pages 7 and 8 in the Official Action. Some of the more egregious examples of unsupported allegations and conclusory statements are that one of ordinary skill in the art would be motivated to combine Viterbi and Parr to create the claimed subject matter (a) by not needing to gather channel response information before decoding begins; (b) by an inherent desire to use both forward and backward channel estimators because Viterbi discloses both forward and backward recursion elements; and (c) because forward and backward recursion elements would both benefit from individual channel estimates derived form soft information produced by forward and backward recursion elements.

The applicant takes exception to the substance of these unsupported allegations and submits that they represent an improper use of official notice. Official notice can properly be used only to establish facts that capable of "instant and unquestionable demonstration as being well-known." <u>In re Ahlert</u>, 424 F.2d 1088, 1091 (CCPA 1970). In contrast, official notice

may not be used as "the principal evidence upon which a rejection is based," <u>Ahlert</u>, 424 F.2d at 1088, or, as done here, as the motivation for combining or modifying references. <u>Ex Parte Grochowski</u>, No. 95-1343, slip op. at 5 (Bd. Pat. App. & Int. June 27, 1995). see also MPEP 2144.03.

Once the Patent Office's hole-filling statements are dismissed for what they are - namely, conclusory and unsupported assertions entitled to no weight or credence - the patentability of claims 1 and 16 is apparent. Thus, the rejection should be withdrawn.

(B) The Prior Art Teaches Away from the Combination

Notwithstanding, the subject matter of independent claims 1 and 16 is not obvious because the prior art teaches away from a combination of Viterbi and Parr that results in the claimed subject matter.

The independent claims 1 and 16 are directed towards estimation of inputs and outputs of a digital transmission system, where forward and backward recursion is used to generate soft information and that soft information is used to estimate channel parameters. For example, claim 1 is directed towards a system that comprises forward and backward recursion elements that generate soft information and that soft information is used by channel estimators to estimate channel parameters.

The prior art teaches away from the claimed subject matter by teaching a combination of forward recursion to generate soft information and forward channel estimation of that soft information. Examples of this prior art can be found in Baccarelli, Iltis et al. (Ronald A. Iltis, John J. Shynk, and K. Giridhar, <u>Bayesian Algorithms for Blind Equalization Using Parallel Adaptive Filtering</u> (42 IEEE Transactions on

Communications, No. 2/3/4 (Feb./Mar./Apr. 1994)), Iltis (R. A. Iltis, <u>A Bayesian Maximum-Likelihood Sequence Estimation Algorithm for A Priori Unknown Channels and Symbol Timing</u>, 10 Journal of Selected Areas in Communications, 579-588, (Apr. 1992)), and Zhang et al. (Y. Zhang, M. P. Fitz, and S. B. Gelfand, <u>Soft Output Demodulation on Frequency-Selective Rayleigh Fading Channels using AR Channel Models</u>, Global Communications Conference, 327-331 (Nov. 1997)). This technique teaches away from using forward and backward recursion with forward and backward channel estimation, as forward trellis recursion with forward channel estimation, without backward recursion or backward estimation, advantageously allows algorithms of hard decisions making to be used (with little or no modification).

Thus, the fact that the prior art teaches away from the claimed subject matter is strong evidence that the claims are non-obvious.

Because the rejection of claims 1 and 16 are unsupported by evidence and there is strong evidence of teaching away, the rejection of claims 1 and 16 should be withdrawn. In addition, because claims 2-6, 11-13, and 15 depend, directly or indirectly, on claim 1, the rejection of these claims should be withdrawn as well.

Conclusion

In view of the above amendments and remarks, all of the claims are in condition for allowance. A formal notice to that effect is respectfully requested.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or
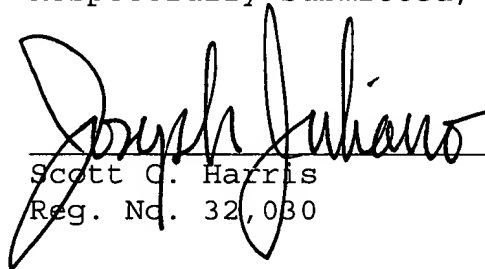
concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Please apply any charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: 12/21/2004

Scott C. Harris
Reg. No. 32,030

SIGNED BY
JOSEPH JULIANO
REG. NO. 54,780

PTO Customer No. 20985
Fish & Richardson P.C.
12390 El Camino Real
San Diego, California 92130
Telephone: (858) 678-5070
Facsimile: (858) 678-5099

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Amendments to the Drawings:

The attached replacement sheets of drawings are formal drawings that include changes to FIGS. 1A-1B, 2A-2B, 3A-3C, and 6.

Attachments following last page of this Amendment:

Replacement Sheets (17 pages)